AMBIENT AIR QUALITY IN THE VICINITY OF THE VICTORIA HOSPITAL ENERGY-FROM-WASTE PLANT

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Minister

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SUMMARY

Throughout 1987 the Ministry of the Environment conducted ambient air monitoring at four fixed sites in the vicinity of the Energy From Waste Plant of the Victoria Hospital Corporation of London. The Energy From Waste Plant started incinerating municipal refuse in August of 1987.

The monitoring consisted of continuous sulphur dioxide, dustfall and total suspended particulate matter. Dustfall samples were analyzed for 16 metals and total suspended particulate samples were routinely analyzed for 14 parameters. In addition some special total suspended particulate sampling was conducted using polyflon filters which were analyzed for a number of additional parameters.

There was no discernible impact on ambient air quality caused by the emissions from the Energy From Waste Plant. Levels of the air contaminants measured were generally low and met the criteria for desirable ambient air quality.

The monitoring at fixed sites is part of a larger environmental assessment which includes ambient air monitoring using mobile monitoring vans, vegetation and soil sampling and stack sampling.

INTRODUCTION

In accordance with the terms and conditions of approval to proceed with the Energy From Waste (EFW) facility for the Victoria Hospital Corporation of London, the Ministry established four fixed ambient air monitoring stations near the EFW. Air monitoring at the stations began in May 1986 which was approximately one year prior to the scheduled start up of the EFW facility.

The EFW facility started to incinerate municipal refuse in August 1987. This report addresses the Ministry's ambient air monitoring conducted at the four fixed sites established in 1986. The 1986 data was presented in "Ambient Air Quality During the Pre-start-up Period of the Victoria Hospital Energy from Waste Plant", Ontario Ministry of the Environment, March 1988.

In addition to the fixed ambient air monitoring sites, the Ministry has also conducted air monitoring surveys using mobile monitoring vans, and phytotoxicology studies. These studies have been conducted both during the operation of the EFW and prior to the EFW start-up. In addition more studies are planned for the first three years of operation of the EFW. Formal reports have been released or are scheduled to be released on these surveys.

DESCRIPTION OF MONITORING NETWORKS

The four fixed ambient air monitoring stations are equipped with samplers to collect dustfall and total suspended particulate matter. In addition three of the sites have continuous sulphur dioxide gas monitors. The locations of the monitoring stations are shown in Figure 1. Table 1 contains a description of the monitoring sites and the monitoring equipment. The four locations are in the vicinity of areas described in the Environmental Assessment hearings as being sensitive or having the greatest potential for experiencing the greatest impact from the emissions of the EFW plant.

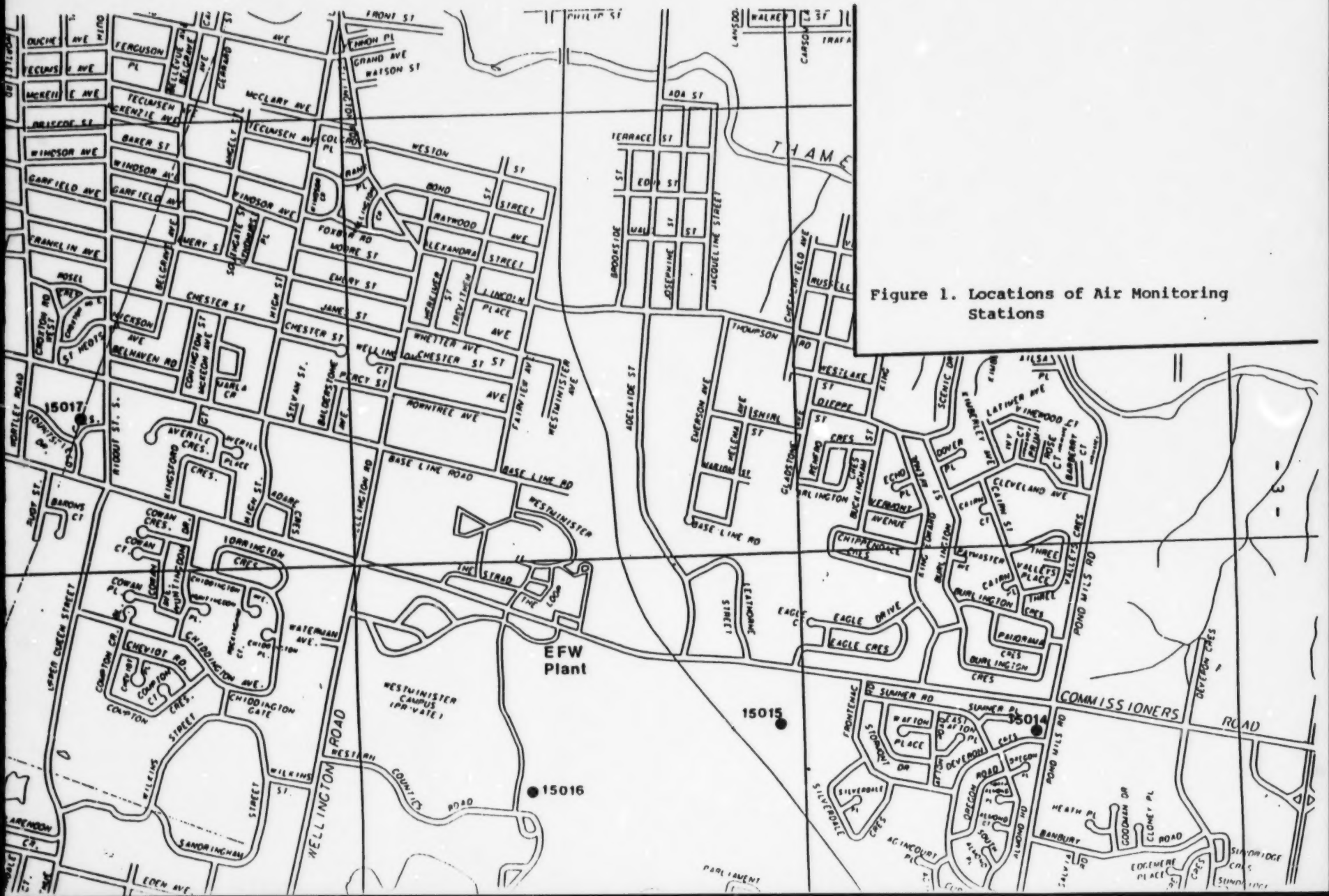

Figure 1. Locations of Air Monitoring Stations

Table 1. Monitoring Station Description

Station Number	Location	Air Intake	Equipment
15014	Corner of Pond Mills and Deveron Crescent on roof of PUC hydro station	4 metres above ground level	Dustfall jar High volume total suspended particulate sampler
15015	951 Commissioners Road East west of Bristol Towers apartments	4 metres above ground level	Dustfall jar High volume total suspended particulate sampler Continuous sulphur dioxide monitor
15016	801 Commissioners Road East southeast of Parkwood Hospital adjacent to barracks	4 metres above ground level	Dustfall jar 2 High volume total suspended particulate samplers Continuous sulphur dioxide monitor
15017	8 Mountsfield Drive on roof of Mountsfield Public School	6 metres above ground level	Dustfall jar High volume total suspended particulate sampler Continuous sulphur dioxide monitor

Air monitoring station 15014 is located on the roof of a Public Utilities Commission hydro station at the corner of Pond Mills Road and Deveron Crescent. This site is aproximately 1.8 km east southeast of the EFW facility. The station is equipped with a dustfall sampler and a total suspended particulate sampler, both of which are approximately four metres above ground level.

Station 15015 is located adjacent to the property of Bristol Towers at 951 Commissioners Road East. The station is approximately 1 km east southeast of the EFW facility. A continuous sulphur dioxide gas analyzer, a dustfall sampler and a total suspended particulate sampler are operated at this station. All air samples are collected at a height of approximately four metres above ground level.

Station 15016 is located on hospital property approximately 0.5 km south of the EFW facility. The station is equipped with sulphur dioxide, dustfall and total suspended particulate monitors and air samples are collected at four metres above ground level. There are two total suspended particulate monitors at this station equipped with different filter media. The different filter media are suitable for different analytical techniques and are used to provide a broader scope of elemental analyses.

Station 15017 is located at Mountsfield Public School approximately 1.7 km west northwest of the EFW facility. Sulphur dioxide, dustfall and total suspended particulate monitors are located at this station. Air samples are collected at six metres above ground level.

A meteorological tower was erected at the EFW in September 1987.

Dustfall samples are collected over a one month period. Dustfall samples are analyzed for the parameters listed in Table 2.

Table 2 List of Parameters Analyzed for in Dustfall Samples

total dustfall	arsenic	antimony
beryllium	cadmium	chromium
copper	iron	lead
lithium	manganese	nickel
selenium	tin	titanium
vanadium	zinc	

Table 3 List of Parameters Analyzed for in Total Suspended Particulate Samples Collected on Glass Fibre Filters

total suspended particulate matter	iron	manganese
cadmium	chromium	copper
lead	nickel	vanadium
antimony	nitrate	sulphate
total carbon	elemental carbon	carbonate carbon

Total suspended particulate samples are collected on glass fibre filters over a 24-hour period (midnight to midnight) on an every-sixth-day sampling schedule. The exhaust from the samplers are vented away from the samplers to prevent contamination of the filters. The samples are analyzed for the different parameters listed in Table 3. Some parameters that are analyzed for in dustfall sample are not analyzed for in suspended particulate samples because of either losses due to volatilization caused by the high flow rate (40 ft^3/min.) used i the total suspended particulate sampling or inaccurate results produced by varying background levels of the elements occurring in the glass fibre sampling filters used to trap the total suspended particulate matter.

In April of 1987 an additional total suspended particulate sampler was installed at station 15016 . This sampler is operated simultaneously with the other TSP sampler but with a polyflon filter instead of a glass fibre filter. The polyflon filter can be analyzed for more parameters than the glass fibre filter. However, developmental work is still required to provide analytical results that would allow the polyflon filter to be used on a routine basis. Therefore, the data presented in this report for polyflon filters should be considered tentative or experimental.

MONITORING AND PROGRAM RESULTS

DUSTFALL

Ontario's criteria for desirable ambient air quality with respect to dustfall is 7.0 grams of dustfall per square metre in 30 days (gm/m^2/30 days) and 4.6 gm/m^2/30 days averaged for one year. These dustfall criteria are in keeping with other control agencies and are based more on historical information than on adverse effects. The criteria for desirable ambient air quality are listed in Table A1, Appendix 1.

Difficulties at the Ministry laboratory resulted in samples for January and March 1987 not being analyzed for antimony, arsenic, beryllium, lithium, selenium, tin, or titanium. The samples for April through December 1987 were analyzed for all the parameters listed in Table 2.

The 1987 dustfall data show that with the exception of 3 samples collected at station 15014 before the start-up of the EFW, the total dustfall levels were low and did not exceed the monthly criterion for desirable ambient air quality. The annual criteria for dustfall was not exceeded at any of the 4 stations.

The levels of the various metals detected in the dustfall samples are very low and were frequently below the detection limits of the analytical procedures. The data reveal no apparent impact on the levels of dustfall or metals in dustfall caused by the emissions from the EFW since the start-up in August 1987.

The 1987 dustfall data are presented in Table A2 to A5 of Appendix 2.

TOTAL SUSPENDED PARTICULATE MATTER

Ontario has criteria for desirable ambient air quality with respect to total suspended particulate matter. The criterion for 24 hours is 120 micrograms of suspended particulates per cubic metre of air (ug/m^3) and there is an annual criterion of 60 ug/m^3 expressed as an annual geometric mean. These criteria are based on impairment of visibility and public awareness.

The annual criterion for TSP was not exceeded at any of the four monitoring sites near the EFW facility. It was exceeded at station 15001, located at the Western Fair Grounds of central London.

The 24-hour criterion for desirable ambient air quality was exceeded at least once at all four monitoring sites near the EFW and at station 15001. However, all the 1987 excursions occurred prior to the incineration of municipal refuse at the EFW. It is not unusual to experience on a specific day excursions at most TSP monitoring sites in southwestern Ontario. These occur when severe dust emissions from sources like open fields or when there are poor dispersion conditions for an extensive period of time.

The levels of constituents analyzed for in the TSP samples are generally very low. For many constituents the highest level measured in 1987 occurred prior to refuse incineration in the EFW. For many of the metal constituents most of the analytical results were near or below the analytical detection limit.

Carbon is reported in the TSP as total, free (or elemental) and carbonate carbon. Free carbon would be coal, soot and graphite while carbonate carbon would be inorganic carbon. Carbon which is not free or carbonate would be organic carbon. Organic carbon constitutes 60 to 75 percent of the total carbon in the suspended particulate material. Much of the organic carbon would be vegetation such as pollen and grasses.

The values reported for sulphate and possibly nitrate are artificially high. This is caused by artifact sulphate being formed on the glass fibre filters when gaseous sulphur dioxide reacts with the filter media. This is a prime reason why the Ministry is using polyflon filters, which do not form sulphate artifact, for some studies.

In general, the total suspended particulate data does not reflect an impact from the start-up of municipal refuse incineration at the EFW. A summary of the data for total suspended particulate samples appears in Tables A6 and A7 of Appendix 3.

It should be noted that although the analytical result for the polyflon and glass fibre filters are similar for some parameters there are some serious discrepancies for other parameters such a cadmium. The reason for these discrepancies are being investigated and is one of the reasons the polyflon filter is not more widely used by the Ministry. The discrepancies notwithstanding, the levels of metals are very low and below those criteria for desirable ambient air quality which have been established.

SULPHUR DIOXIDE

Combustion of sulphur containing fuels comprises the predominant source of man made emissions of sulphur oxides. Sulphur in the refuse burned at the EFW is a source of sulphur dioxide.

The criteria for desirable ambient air quality with respect to sulphur dioxide are 0.25 parts of sulphur dioxide per million parts of air (ppm) averaged for one hour, 0.10 ppm averaged for 24 hours (midnight to midnight) and 0.02 ppm as an annual average. The one-hour and annual criteria were established for the protection of vegetation while the 24-hour criterion serves to protect human health.

These criteria were not exceeded at the three monitoring sites with the SO_2 monitors near the EFW Plant nor at the monitoring station located at the Western Fairgrounds. A summary of the SO_2 data appears in Table 4. It is apparent that SO_2 levels were very low in 1987. Furthermore, there is no discernible impact on ambient levels of sulphur dioxide caused by emissions from refuse combustion at the EFW which started in August 1987.

Table 4 Summary of Sulphur Dioxide Data for 1987

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
Average Concentration (ppm)													
Station 15015	0.003	0.003	0.002	0.001	0.002	0.002	0.000	0.000	0.001	0.001	0.001	0.001	0.001
15016	0.007	0.009	0.002	0.000	0.001	0.006	0.001	0.002	0.006	0.003	0.002	0.003	0.004
15017	0.002	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001
15001	0.007	0.004	0.005	0.006	0.003	0.002	0.000	0.000	0.002	0.002	0.001	0.002	0.003
1-Hour Maximum Value (ppm)													
Station 15015	0.05	0.03	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.05	0.03	0.02	0.05
15016	0.05	0.05	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.07	0.03	0.03	0.07
15017	0.04	0.02	0.02	0.02	0.04	0.03	0.02	0.02	0.02	0.06	0.03	0.02	0.06
15001	0.05	0.04	0.03	0.08	0.08	0.05	0.02	0.01	0.02	0.06	0.04	0.02	0.08
24-Hour Maximum Value (ppm)													
Station 15015	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01
15016	0.02	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.02
15017	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
15001	0.02	0.01	0.01	0.02	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.02

Note: Desirable ambient air quality criteria are: 0.25 ppm for 1 hour
0.10 ppm for 24 hours
0.02 ppm for annual average

CONCLUSIONS

The 1987 monitoring program did not reveal any unusually high levels of pollution nor any discernible impact created by emissions from refuse incineration at the EFW.

Levels of sulphur dioxide, dustfall and total suspended particulates were generally low and normally met the criteria for desirable ambient air quality. The few excursions that were measured above the criteria for dustfall and total suspended particulate occurred prior to municipal refuse incineration in the EFW. Levels of metals in dustfall and total suspended particulate matter were also low and demonstrated no appreciable impact from the EFW emissions.

APPENDIX 1

CRITERIA FOR DESIRABLE AMBIENT

AIR QUALITY

Table A1 Criteria for Desirable Ambient Air Quality

Name of Contaminant	Average Amount of Concentration (ug/m^3)	Period of Time	Comment
Cadmium	2	24 hours	Regulation 296
Lead	5	24 hours	Regulation 296
	2 (geometric mean)	30 days	Regulation 296
	3 (arithmetic mean)	30 days	
Nickel	2	24 hours	Regulation 296
Vanadium	2	24 hours	Regulation 296
Chromium	1.5	24 hours	
Copper	50	24 hours	
Manganese	50	24 hours	
Selenium	10	24 hours	Guideline
Tin	10	24 hours	
Titanium	100	24 hours	
Zinc	100	24 hours	
Total Suspended Particulates	120	24 hours	Regulation 296
	60	Annual geometric mean	Regulation 296
Dustfall	7.0 gm/m^2/30 days	30 days	Regulation 296
Dustfall	4.6 gm/m^2/30 days	1 year	Regulation 296
Sulphur dioxide	0.25 ppm	1 hour	Regulation 296
	0.10 ppm	24 hours	Regulation 296
	0.02 ppm	1 year	Regulation 296

APPENDIX 2

DUSTFALL DATA

Table A2. Monthly Results for Dustfall Samples (g/m²/30 days) from Station 15014.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dustfall	0.8		1.3	2.7	3.1	2.8	0.8	1.6	1.6	1.4	0.3	1.2	1.6
Antimony				0.000	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Arsenic				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Beryllium				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Cadmium	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Chromium	0.000		0.000	0.000	<0.002	<0.002	0.000	0.000	0.000	0.000	0.000	0.000	
Copper	0.000		0.000	0.001	<0.001	<0.001	0.000	0.000	0.000	0.001	0.000	0.001	
Iron	0.00		0.01	0.02	0.00	0.00	0.01	0.02	0.01	0.01	0.01	0.01	
Lead	0.000		0.001	0.002	<0.005	<0.005	<0.001	0.001	0.001	0.001	0.000	0.001	
Lithium				0.000	<0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Manganese	0.000		0.001	0.001	<0.001	<0.001	0.000	0.001	0.001	0.001	0.000	0.001	
Nickel	0.000		0.000	0.001	<0.002	<0.002	0.000	0.000	0.000	0.000	0.000	0.000	
Selenium				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Tin				0.000	<0.005	<0.005	0.000	<0.000	0.000	0.000	0.000	0.000	
Titanium				0.000	<0.001	<0.001	0.000	0.001	0.001	0.007	0.000	0.001	
Vanadium	0.000		0.000	0.000	<0.02	<0.02	0.000	0.000	0.000	0.000	0.000	0.000	
Zinc	0.001		0.001	0.002	<0.001	<0.001	0.000	0.002	0.001	0.002	0.000	0.002	

Note: Desirable ambient air quality criteria for dustfall are: 7.0 gm/m²/30 days
4.6 gm/m² as an annual average.

Table A3. Monthly Results for Dustfall Samples (g/m²/30 days) from Station 15015.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dustfall	0.4		1.6	10.8	7.4	8.0	3.1	3.5	4.3	1.2	0.6	1.7	3.9
Antimony				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Arsenic				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Beryllium				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Cadmium	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Chromium	0.000		0.000	0.000	<0.002	<0.002	0.000	0.000	0.000	0.000	0.001	0.000	
Copper	0.000		0.001	0.003	<0.001	<0.001	0.001	0.001	0.001	0.002	0.001	0.001	
Iron	0.00		0.07	0.04	0.00	0.00	0.02	0.01	0.02	0.01	0.01	0.00	
Lead	0.00		0.001	0.001	<0.005	<0.005	0.000	0.000	0.001	0.000	0.000	0.001	
Lithium				0.000	<0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Manganese	0.000		0.004	0.004	<0.001	<0.001	0.001	0.001	0.001	0.001	0.000	0.001	
Nickel	0.000		0.000	0.000	<0.002	<0.002	0.000	0.000	0.000	0.000	0.001	0.000	
Selenium				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Tin				0.000	<0.005	<0.005	0.000	0.000	0.000	0.000	0.000	0.000	
Titanium				0.000	<0.001	<0.001	0.001	0.001	0.002	0.001	0.000	0.001	
Vanadium	0.000		0.000	0.000	<0.02	<0.02	0.000	0.000	0.000	0.000	0.000	0.000	
Zinc	0.001		0.004	0.005	<0.001	0.001	0.002	0.002	0.001	0.001	0.002	0.007	

Note: Desirable ambient air quality criteria for dustfall are: 7.0 gm/m²/30 days
4.6 gm/m² as an annual average.

Table A4. Monthly Results for Dustfall Samples (g/m²/30 days) from Station 15016.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dustfall	0.5		0.9	1.3	3.6	2.2	2.3	1.9	0.8	1.2	0.4	1.4	1.5
Antimony				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Arsenic				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Beryllium				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Cadmium	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Chromium	0.000		0.000	0.000	<0.002	<0.002	0.000	0.000	0.000	0.000	0.001	0.000	
Copper	0.000		0.001	0.001	<0.001	<0.001	0.000	0.000	0.001	0.001	0.000	0.000	
Iron	0.00		0.00	0.01	0.00	<0.002	0.01	0.01	0.01	0.01	0.00	0.01	
Lead	0.000		0.000	0.000	<0.005	<0.005	0.000	0.000	0.001	0.001	0.000	0.000	
Lithium				0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Manganese	0.000		0.001	0.001	<0.001	<0.001	0.001	0.001	0.001	0.001	0.000	0.000	
Nickel	0.000		0.000	0.000	<0.002	<0.002	0.000	0.000	0.000	0.000	0.000	0.000	
Selenium				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Tin				0.000	<0.005	<0.005	0.000	0.000	0.000	0.000	0.000	0.000	
Titanium				0.000	<0.001	<0.001	0.001	0.001	0.001	0.001	0.001	0.001	
Vanadium	0.000		0.000	0.000	<0.02	<0.02	0.000	0.000	0.000	0.000	0.000	0.000	
Zinc	0.001		0.004	0.002	<0.001	<0.001	0.003	0.002	0.002	0.001	0.001	0.001	

Note: Desirable ambient air quality criteria for dustfall are: 7.0 gm/m²/30 days
4.6 gm/m² as an annual average.

Table A5. Monthly Results for Dustfall Samples (g/m²/30 days) from Station 15017.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dustfall	0.3		1.7	1.2	3.8	3.2	2.0	1.4	1.6	1.6	0.4	1.4	1.7
Antimony				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Arsenic				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Beryllium				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Cadmium	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Chromium	0.000		0.000	0.000	<0.002	<0.002	0.000	0.000	0.000	0.000	0.000	0.000	
Copper	0.000		0.000	0.001	<0.001	<0.001	0.000	0.000	0.001	0.001	0.000	0.000	
Iron	0.00		0.02	0.02	0.00	0.00	0.02	0.01	0.01	0.01	0.00	0.01	
Lead	0.000		0.001	0.001	<0.005	<0.005	0.000	0.000	0.001	0.000	0.000	0.000	
Lithium				0.000	0.001	0.002	0.000	0.000	0.000	0.000	0.000	0.000	
Manganese	0.000		0.001	0.001	<0.001	<0.001	0.001	0.001	0.001	0.001	0.000	0.001	
Nickel	0.000		0.000	0.000	<0.002	<0.002	0.000	0.000	0.000	0.000	0.000	0.000	
Selenium				0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	
Tin				0.000	<0.005	<0.005	0.000	0.000	0.000	0.000	0.000	0.000	
Titanium				0.000	<0.001	<0.001	0.001	0.001	0.001	0.001	0.001	0.001	
Vanadium	0.000		0.000	0.000	<0.02	<0.02	0.000	0.000	0.000	0.000	0.000	0.000	
Zinc	0.000		0.002	0.001	<0.001	<0.001	0.002	0.001	0.002	0.001	0.001	0.001	

Note: Desirable ambient air quality criteria for dustfall are: 7.0 gm/m²/30 days
4.6 gm/m² as an annual average.

APPENDIX 3

DATA FOR TOTAL SUSPENDED PARTICULATES

Table A6: Summary of data for total suspended particulate samples (ug/m³)

	Station 15001	15014	15015	15016 glass fibre	15016 polyflon	15017
Total number of samples collected (1987)	57	60	58	58	45	58
Total suspended particulate						
Annual geometric mean	65	52	43	46	52	49
Percentage of values greater than 24-hour criterion	15.8	8.3	1.7	3.4	6.7	3.4
Maximum 24-hour value before start up	282	175	164	208	279	191
Maximum 24-hour value after start up	98	87	77	95	79	74
Antimony						
Annual Average		0.001	0.001	0.001		0.001
Maximum 24-hour value before start up		0.003	0.002	0.003		0.002
Maximum 24-hour value after start up		0.005	0.006	0.006		0.006
Cadmium						
Annual Average	0.001	0.001	0.001	0.000	0.024	0.000
Maximum 24-hour value before start up	0.008	0.003	0.003	0.003	0.00	0.003
Maximum 24-hour value after start up	0.003	0.003	0.001	0.001	0.229	0.001
Total Carbon						
Annual Average		6.2	4.7	5.4		5.9
Maximum 24-hour value before start up		17.4	12.6	17.6		15.2
Maximum 24-hour value after start up		9.2	7.9	8.9		9.5

Table A6: Summary of data for total suspended particulate samples (ug/m³)

	Station 15001	15014	15015	15016 glass fibre	15016 polyflon	15017
Free Carbon						
Annual Average		1.7	1.1	1.0		1.3
Maximum 24-hour value before start up		7.3	4.6	3.0		4.9
Maximum 24-hour value after start up		3.1	1.8	2.3		2.1
Carbon as Carbonate						
Annual Average		0.6	0.2	0.6		0.4
Maximum 24-hour value before start up		5.7	1.7	11.0		3.6
Maximum 24-hour value after start up		1.4	0.7	3.0		1.5
Chromium						
Annual Average	0.010	0.009	0.007	0.008	0.012	0.007
Maximum 24-hour value before start up	0.030	0.020	0.020	0.020	0.042	0.010
Maximum 24-hour value after start up	0.010	0.020	0.010	0.010	0.029	0.010
Copper						
Annual Average		0.03	0.02	0.03	0.08	0.03
Maximum 24-hour value before start up		0.09	0.06	0.11	0.17	0.07
Maximum 24-hour value after start up		0.07	0.03	0.05	0.20	0.08

Table A6: Summary of data for total suspended particulate samples (ug/m³)

	Station 15001	15014	15015	15016 glass fibre	15016 polyflon	15017
Iron						
Annual Average	1.1	0.8	0.6	0.7	0.8	0.7
Maximum 24-hour value before start up	6.8	5.9	3.3	5.8	5.2	5.1
Maximum 24-hour value after start up	1.7	1.3	1.1	1.0	0.9	1.1
Lead						
Annual Average	0.2	0.1	0.1	0.1	0.1	0.1
Maximum 24-hour value before start up	0.9	0.7	0.3	0.3	0.1	0.4
Maximum 24-hour value after start up	0.2	0.2	0.1	0.1	0.4	0.1
Manganese						
Annual Average	0.042	0.033	0.025	0.028	0.036	0.027
Maximum 24-hour value before start up	0.210	0.120	0.080	0.110	0.165	0.100
Maximum 24-hour value after start up	0.120	0.060	0.060	0.080	0.080	0.050
Nickel						
Annual Average	0.005	0.005	0.009	0.005	0.008	0.004
Maximum 24-hour value before start up	0.010	0.010	0.050	0.010	0.026	0.010
Maximum 24-hour value after start up	0.010	0.020	0.050	0.010	0.031	0.010

Table A6: Summary of data for total suspended particulate samples (ug/m³)

	Station 15001	15014	15015	15016 glass fibre	15016 polyfion	15017
Nitrate						
Annual Average	5.3	4.9	5.2	4.9		4.9
Maximum 24-hour value before start up	17.5	14.2	12.9	11.1		12.4
Maximum 24-hour value after start up	11.1	9.7	10.0	11.5		10.1
Sulphate						
Annual Average	9.4	9.7	10.7	10.3		10.3
Maximum 24-hour value before start up	24.6	23.4	24.2	19.6		24.4
Maximum 24-hour value after start up	17.6	24.1	27.1	27.1		23.9
Vanadium						
Annual Average	0.007	0.009	0.007	0.008	0.007	0.007
Maximum 24-hour value before start up	0.020	0.020	0.010	0.030	0.037	0.010
Maximum 24-hour value after start up	0.010	0.030	0.020	0.020	0.014	0.020

Table 7A: Summary of additional data for parameters measured using Polyflon filter at station 15016 during 1987.

Parameter	Annual Average (ug/m^3)	Maximum 24-hour value before start up (ug/m^3)	Maximum 24-hour value after start up (ug/m^3)
Aluminium	0.8	4.8	1.1
Bromine	0.019	0.033	0.082
Calcium	2.56	7.99	5.52
Chlorine	0.12	0.58	0.57
Phosphorus	0.031	0.137	0.044
Potassium	0.5	2.7	0.8
Silicon	2.618	15.818	3.179
Strontium	0.025	0.042	0.187
Sulphur	0.6	2.1	1.3
Titanium	0.088	0.569	0.113
Zinc	0.0	0.1	0.2
Zirconium	0.05	0.08	0.18